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LAUNCH MISSION SUMMARY

FLTSATCOM-D

ATLAS/CENTAUR-57

National Aeronautics and
Space Administration

John F. Kennedy Space Center

NASA

FLTSATCOM-D

FLTSATCOM (pronounced FleetSatCom, for Fleet Satellite Communications) is a versatile military satellite communications system. It serves the U.S. Navy, U.S. Air Force, and the Department of Defense. The FLTSATCOM system also supports the U.S. Presidential Command Network. Space Division, Los Angeles, AFS, CA of the U.S. Air Force Systems Command controls the spacecraft, operating through its Satellite Control Facility network stations.

Satellites in the FLTSATCOM series will be spaced around the globe. FLTSATCOM terminals will be installed on naval aircraft, ships, and submarines, and at Navy land bases. The Air Force share of each satellite has become part of the USAF Satellite Communications System (AFSatCom). AFSatCom links the National Command Authority with Strategic Air Command (SAC) units, and other arms of the Air Force.

FLTSATCOM-D weighs about 1,864 kilograms (4,109 pounds) on the ground, and has a mass of 992 kilograms (2,187 pounds) in space after burning up the apogee motor propellants (the motor case remains attached to the spacecraft). It is 13.2 meters (43.4 feet) long from end to end of the solar panels after they are deployed. The main body is 2.3 meters (7.5 feet) wide. It is 5.1 meters (16.7 feet) from the bottom of the main body to the top of the spiral mast in the center of the dish antenna (the offset arm-mounted antenna mast extends some 1.5 meters (4.9 feet) higher). Each of the three-panel solar arrays is 3.8 meters (12.6 feet) high and 2.8 meters (9.2 feet) wide. The FLTSATCOM is the largest and heaviest spacecraft ever to be launched into geosynchronous orbit by an ATLAS/CENTAUR vehicle.

The main body of a FLTSATCOM consists of two stacked hexagonal modules, called the payload and the spacecraft. The three antenna systems extend from the top of the payload module. The two arms supporting the solar arrays extend from two sides of the spacecraft module, near the level where the two modules join.

The spacecraft module contains the hydrazine-fueled Reaction Control System (RCS) thrusters and tanks, a reaction wheel which continually spins to provide spacecraft stability, sun and earth sensors, control and auxiliary electronics, three batteries, the electrical power/distribution system, and the other systems needed for control and operation of the spacecraft. It also contains the electronic packages for the S-band system.

The UHF transmit antenna consists of a silver-filled stainless steel mesh dish 4.9 meters (16 feet) in diameter, with a central spiral mast. The UHF receive antenna is an offset spiral mast set well away from the main dish. The S-band antenna is a conical helix sitting on top of the central antenna mast, but electronically isolated from the UHF. The SHF is a horn antenna mounted in such a fashion it transmits through a hole cut in the main dish. This hole is covered with a mesh which is transparent to SHF radiation but reflects UHF, preventing interference between the two systems.

In operation the spacecraft module momentum wheel provides a means to maintain spacecraft attitude, holding the three antenna systems focused on the earth. The two solar wings rotate on their extended arms, keeping the solar cells exposed to sunlight as the spacecraft circles around the earth. The two wings contain a total of 22,632 solar cells, of the "N" on "P" type, of which 2,760 are used for battery charging and the remainder for normal operations. Each cell is 2X4 centimeters in size. The solar arrays will produce a minimum of 1,400 watts for at least five years. The three batteries provide up to 600 watt-hours at 25 volts, decreasing to about 500 watt-hours near the end of expected spacecraft life. This is enough to handle all mandatory power requirements during the two time periods each year when a FLTSATCOM must operate in the earth's shadow.

The FLTSATCOM system provides reliable, secure communications for United States ships and planes operating almost anywhere in the world, as well as ship-to-shore and plane-to-ground contact with the Presidential Command Network and senior military officers in the United States. FLTSATCOM spacecraft are built for the military services by TRW, Inc.

ATLAS-CENTAUR VEHICLES

The two-stage ATLAS/CENTAUR combination, built by General Dynamics/Convair (GDC), has launched a wide variety of scientific and technological spacecraft. These have included Surveyors to the moon, Mariners to Venus, Mercury, and Mars, Pioneers to Venus, Jupiter and Saturn, and INTELSAT and COMSTAR communications satellites into geosynchronous earth orbit.

The 21.3 meter (70 foot) first stage is an uprated version of the flight-proven ATLAS vehicle. The Rockwell International/Rocketdyne MA-5 engine system burns RP-1, a highly refined kerosene, and liquid oxygen. The MA-5 utilizes two main engines, a 1,646,000 Newtons (370,000 pounds) of thrust booster with two thrust chambers, and a smaller sustainer with a single chamber that produces 266,900 Newtons (60,000 pounds) of thrust. Two smaller vernier engines which help control the vehicle in flight are also burning at liftoff, for a total thrust of 1,917,000 Newtons (431,000 pounds). Vehicle weight varies according to payload. For this mission, total vehicle weight at liftoff is about 149,050 kilograms (328,600 pounds).

After about 2 1/2 minutes of flight the booster engine cuts off and it and its supporting structures are jettisoned. An ATLAS thus drops a large portion of its structural weight without having to ignite an engine in flight, as a separate stage must. The sustainer and vernier engines continue to burn until propellant depletion, at a little over four minutes.

The only radio frequency system on the ATLAS is a range safety command system, consisting of two receivers, a power control unit, and a destruct unit. The ATLAS can be destroyed in flight if necessary, but otherwise receives all its control directions from the CENTAUR stage.

The CENTAUR stage sits above the ATLAS, on a barrel-shaped interstage adapter. The ATLAS and CENTAUR separate two seconds after the ATLAS burns out. Eight small retrorockets near the bottom of the ATLAS fuel tank then back this stage away from the CENTAUR.

The CENTAUR stage is 14 meters (46 feet) in length. Exclusive of payload, it weighs about 17,700 kilograms (39,000 pounds) when loaded with propellants. The main propulsion system consists of two Pratt & Whitney engines burning liquid oxygen and liquid hydrogen, producing 133,400 Newtons (30,000 pounds) of thrust in the vacuum of space in which they are designed to operate. These engines can be stopped and restarted, allowing the CENTAUR to coast to the best point from which to achieve its final trajectory before igniting for the final burn. While coasting, the stage is controlled by 12 small thrust engines, powered by hydrogen peroxide. These hold the stage steady and provide a small constant thrust to keep the propellants settled in the bottom of their tanks, a necessity for a second or third burn.

A cylindrical nose fairing with a conical top sits on the CENTAUR and protects the spacecraft. This nose fairing comes in two lengths, (the standard ATLAS/CENTAUR nose fairing, used by FLTSATCOM, or an extended version) depending on spacecraft height; total vehicle height is either 39.9 or 40.8 meters (131 or 134 feet). Both fairings are three meters (10 feet) in diameter.

The CENTAUR astrionics system provides integrated flight control for both itself and the ATLAS. The heart of this system is an airborne Digital Computer Unit (DCU), built by Teledyne. The DCU is an advanced, high-speed computer with a 16,384 word random access memory. It issues commands which control the sequence of operations for both stages. It also issues steering commands to the engines, operating on guidance information furnished by the Inertial Measurement Group (IMG). The IMG, built by Honeywell, determines how accurately the vehicle stages are following the planned flight path, allowing the DCU to correct for any deviations by issuing new steering commands.

The DCU and other electronic packages are mounted in a circle around a conical equipment module, located above the upper CENTAUR tank. In addition to providing guidance and determining the sequence of events, these packages perform the navigation, autopilot, attitude control, and telementry and data management functions for both stages. The CENTAUR also has a ground-controlled destruct system similar to that on the ATLAS, in case the stage must be destroyed in flight.

The CENTAUR utilizes the most powerful propellant combination available, has a light-weight structure, and the longest burn time of any stage now in service. This gives it more total energy for its size than any stage yet built.

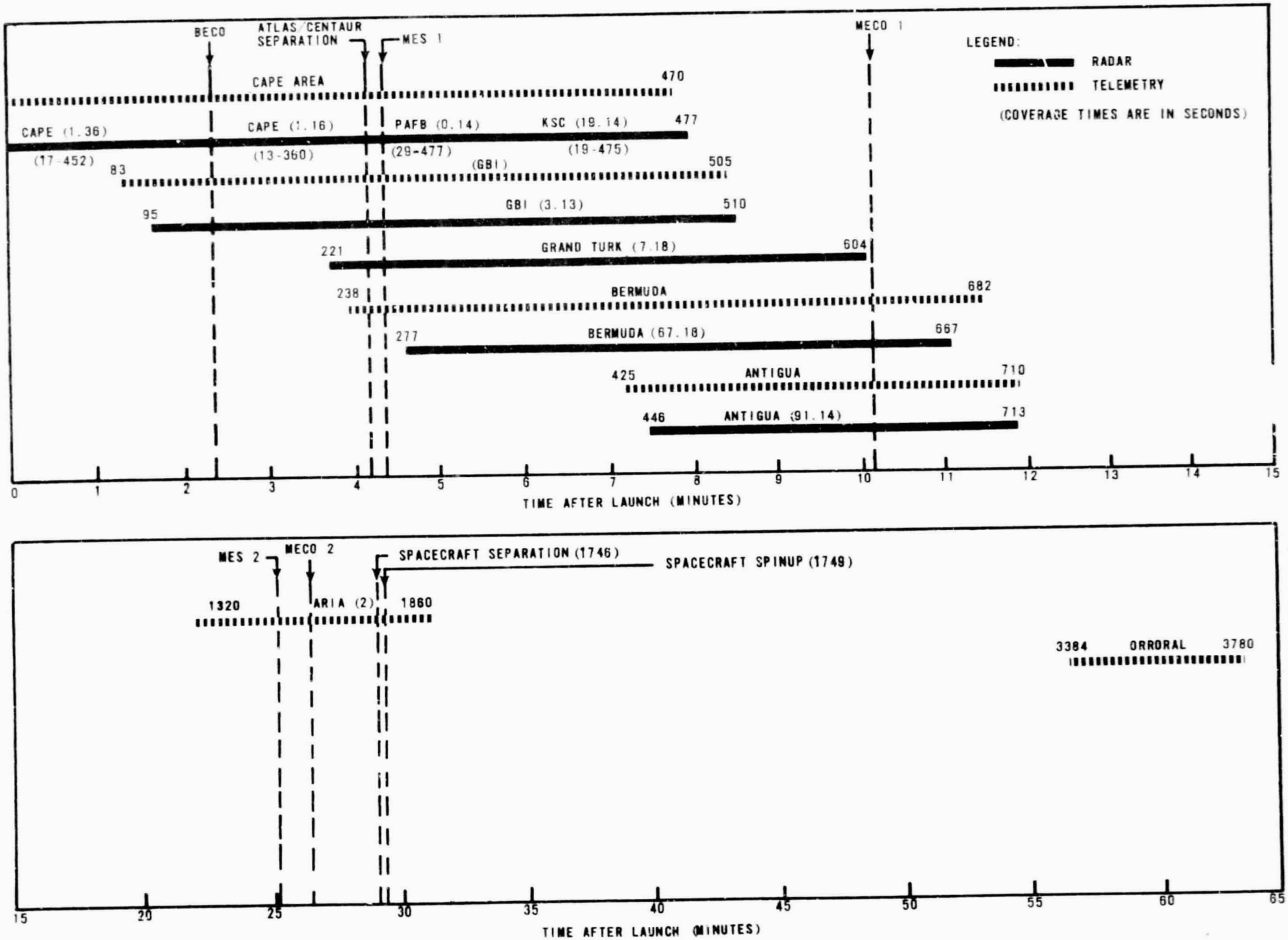
FLIGHT PLAN

The ATLAS/CENTAUR vehicle will rise vertically from Launch Complex 36-A until 15 seconds of flight time have elapsed. During the interval from 2 to 15 seconds, the CENTAUR DCU will roll the vehicle from the launch pad azimuth (105 degrees) to the desired flight azimuth of 94.4 degrees.

The ATLAS booster and the first burn of the CENTAUR will inject the vehicle into an 148-kilometer (80-nautical-mile) perigee by 363-kilometer (196-nautical-mile) apogee elliptical parking orbit. The parking orbit will be designed to obtain metric and telemetry data without range ships. After an approximate 15-minute coast period in the parking orbit, a second CENTAUR burn near the first equatorial crossing will provide a small plane change and inject the vehicle into an inclined Hohmann transfer ellipse. Two ARIA aircraft will be required for telemetry coverage (only) of the second burn and spacecraft separation. After second Main Engine Cutoff (MECO 2), the CENTAUR will execute a turn to orient the FLTSATCOM-D spacecraft to its required attitude for the transfer orbit. This attitude places the spacecraft spin axis normal to the plane of the transfer orbit, with the antenna end of the spacecraft pointing in a generally southern direction. The FLTSATCOM will spin up, in roll, shortly after separation, to stabilize the spacecraft during the coast to apogee. The CENTAUR will turn approximately 90 degrees after spacecraft separation, and perform a retromaneuver. The retromaneuver includes a propellant tank blowdown through the main engines to increase the separation distance from the spacecraft.

The FLTSATCOM missions require injection of the satellites into a near-geosynchronous equatorial orbit. The nominal parameters of such an orbit are a 23.935-hour period, an altitude of 35.811 kilometers (19,324 nautical miles), near zero eccentricity, and a 2.4° inclination with respect to the equatorial plane. An apogee motor on the FLTSATCOM-D is used to circularize the transfer orbit and reduce the inclination from 27.1° in the transfer orbit to 2.4°. The spacecraft then drifts to its assigned place in the FLTSATCOM global network, where spacecraft controllers fire the hydrazine-powered Reaction Control System (RCS) to stop the drift motion.

Since FLTSATCOM-D will initially be crossing the equator at an angle of 2.4 degrees, it will appear from the ground to be moving back and forth from north to south, about 267 kilometers (144 nautical miles) each way from the equator. At the same time it will appear to move slightly east and west from the centerpoint, and so trace a constant figure 8 in the sky. These oscillations will be gradually decreased by the controllers, until the satellite appears to be motionless above the equator.



ANTICIPATED RADAR AND TELEMETRY COVERAGE, FLTSATCOM-D

FLTSATCOM-D SELECTED TRAJECTORY INFORMATION

Events	Time (seconds)	Time (min:sec)	Surface Range (nautical miles)	Altitude (nautical miles)
Liftoff	T=0	---	0	0
BECO	T+139	2:19	43	30
SECO	T+255	4:15	217	78
ATLAS/CENTAUR Separation	T+257	4:17	220	79
MES 1	T+263	4:23	233	81
MECO 1	T+611	10:11	1175	91
MES 2	T+1514	25:14	4723	88
MECO 2	T+1611	26:51	5163	97
Spacecraft Separation	T+1746	29:06	5846	158

NOTE: All data are nominal and may vary, depending on exact launch date, launch time, and spacecraft flight weight.

LAUNCH WINDOWS

The planned launch date for FLTSATCOM-D is October 28/29, 1980. The launch window for this date, plus launch opportunities for the remainder of October thru November 6/7, are as follows:

Launch Window Times

Date	EST (Open) (Close)	GMT (Open) (Close)	Window Duration (minutes)
October 28/29	2213 - 2338	0313 - 0438	125
29/30	2215 - 2344	0315 - 0444	129
30/31	2217 - 2350	0317 - 0450	133
October/ November 31/1	2219 - 2356	0319 - 0456	137
November 1/2	2221 - 0008	0321 - 0508	187
2/3	2223 - 0246	0323 - 0746	432
3/4	2225 - 0245	0325 - 0745	420
4/5	2227 - 0244	0327 - 0744	417
5/6	2229 - 0243	0329 - 0743	414
6/7	2231 - 0242	0331 - 0742	411

NOTE: All EST times (except EST closing times from 1 November to 6 November) occur on the first date listed. All GMT times and all EST closing times from 1 November to 6 November, occur on the second date listed.